

REMARKS

In his Office Action, the Examiner rejected Claims 1 – 18 as anticipated or made obvious by Liou et al. US Patent No. 5,457,569 (“Liou”), either taken alone or (with respect to Claims 17 – 18) in combination with Lear, US Patent No. 5,633,527 (“Lear”). Preliminarily Applicants note that on page 2 of the Action, the Examiner identified Liou with US Patent No. 5,457,568, a patent issued to Jacobovitz-Veselka et al. Given the Examiner’s identification elsewhere of the principal reference as Liou et al. US Patent No. 5,457,569, Applicants are assuming that the mention on page 2 of the Examiner’s Action of US Patent No. 5,457,568 was a typographical error. As understood, Applicants respectfully traverse these grounds for rejection as applied to the claims as amended.

Claim 1, the only independent claim now in the application, has been amended to include the limitation that the lens region comprises a quantum well intermixed (QWI) region. Liou does not show or suggest a QWI lens region. Liou describes forming a lens region "by varying the thickness of the active layer and/or the passive waveguide layer at the location defining the lens" (Column 4, lines 37 to 39). This is taken to mean that the thickness of the relevant layer is changed for the area defined by the "aspherical lens" as shown in Liou’s Figure 3. This is confirmed by Liou, Col. 4, lines 19 – 28:

...the refractive index difference for the lens is produced by the difference in the core thickness between the amplifying section 20 and the passive waveguiding section 22 of the device. This change in thickness results in the absence of the active layer 13 in the passive waveguiding section 22 so that the core is composed only of the passive waveguiding layer 11. For the particular material system shown in FIG. 3, the calculated refractive index step $\Delta n/n$ from the amplifying section 20 to the passive waveguiding section 22 is 2.3%.

The nonobviousness of using quantum well intermixing (QWI) to form a lens region as claimed is demonstrated by at least the following significant technical advantages over the step

change layer thickness approach of Liou.

Firstly, it avoids the necessity for etch and re-growth processes (such as in Liou) which are difficult and expensive, with reduced yields.

Secondly, as discussed in Applicants' Specification at page 8, lines 19-25, the "use of a QWI technique to form the integrated lens region in the substrate enables the achievement of superior spatial resolution not available with other techniques for locally modifying refractive index in the substrate", e.g. techniques such as the layer thickness variation described in Liou.

Further, since Liou offers a complete solution to the formation of the lens as described therein, there is no motivation, teaching or suggestion that an alternative approach could be adopted.

The remaining claims are patentable at least for their dependency on allowable Claim 1. In addition, Claim 3 points out that Applicants' QWI lens formation technique offers the significant benefits of the ability to form lenses in which "the depth of the lens region varies as a function of distance along the longitudinal axis, the depth being defined as the axis orthogonal to the longitudinal axis and the surface of the substrate." This is shown in Applicants' Figures 6 and 7. In other words, focusing of the beam can be achieved in the x-z plane as well, and optionally in the orthogonal y-z plane as enabled by the features of Claim 5.

Liou simply does not and cannot teach this approach because the modification of layer thickness as proposed cannot readily vary the thickness numerous times as a function of distance along the longitudinal axis. To do so would require numerous layer thickness changes which would be prohibitive in manufacturing complexity and reduced yield. Nor does the Examiner's secondary reference, Lear US 5,633,527, teach or suggest the use of QWI to create a lens region. The claims as amended are therefore patentable over the prior art.

This Reply to Examiner's Action is being submitted within the initial three-month shortened statutory period, and Applicant's amendments do not necessitate the payment of additional claim fees. Therefore no fee is thought to be due in conjunction with this submission. Nonetheless, the Commissioner is hereby authorized to charge Deposit Account No. 503982 of Momkus McCluskey, LLC to cover any fee deficiency.

Respectfully submitted,

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